Ecological site AX001X01X403
Mesic Udic Dry Forest

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General information

Provisional. A provisional ecological site description has undergone quality control and quality assurance review. It contains a working state and transition model and enough information to identify the ecological site.

MLRA notes

Major Land Resource Area (MLRA): 001X–Northern Pacific Coast Range, Foothills, and Valleys

This area consists of a long and narrow range of mountains with associated foothills and valleys that parallels the Pacific Ocean. This area is entirely within the Pacific Border Province of the Pacific Mountain System in Oregon and Washington. MLRA 1 is bounded on the north by the highest elevations of the Olympic Mountains and the strait of Juan de Fuca, and by the Klamath Mountains on the south. The Washington portion of this MLRA is primarily composed of young Tertiary sedimentary rocks (siltstone and sandstone) mixed with some volcanic rocks of the same age. Glacial till and outwash deposits are also found in the northern half of this area in Washington. Much of this area is accreted terrane formed by tectonic processes. The average annual precipitation ranges from 60 to 200 inches (1,525 to 5,580 millimeters), increasing with elevation. Most of the precipitation in this area occurs during low-intensity, Pacific frontal storms and is evenly distributed throughout fall, winter, and spring. The dominant soil orders in this MLRA are Andisols, Inceptisols, and Ultisols. Soil depths broadly range from shallow to very deep. Soils are primarily well drained, however poorly drained soils may be found in depressional areas and on alluvial floodplains. Surface textures are typically medial and loamy or clayey. Soils in this area dominantly have a mesic or frigid temperature regime and a udic moisture regime. Soils with aquic moisture regimes and cryic temperature regimes also occur.

Ecological site concept

Mesic Udic Dry Forest sites occur on less stable landscape positions on glacial valley walls and colluvial aprons in the mesic temperature zone. These sites are located on the leeward side of the Olympic Mountains where precipitation is relatively low. Additionally, relatively high slope gradients limit water infiltration on these sites, generating runoff to more stable Mesic Udic Moist Forests, Mesic Aquic Forests, and Temperate Wet Meadows. Mesic Udic Dry Forests are indicated by the presence of dry mesophytic species such as oceanspray (Holodiscus discolor) and dwarf rose (Rosa gymnocarpa). These species may or may not be abundant on Mesic Udic Dry Forest sites, but their presence serves as a strong indicator of this site. Mesic Udic Dry Forest sites are characterized by an overstory canopy of western hemlock (Tsuga heterophylla) and Douglas-fir (Pseudotsuga menziesii), accompanied by an understory shrub community of oceanspray and dwarf rose. The herbaceous layer is dominated by western swordfern (Polystichum munitum) and sweet after death (Achlys triphylla), locally known as deerfoot vanilla leaf. Western redcedar (Thuja plicata) may be present as a minor overstory component, particularly in microtopographic depressions. Cascade barberry (Mahonia nervosa) is commonly present in the understory shrub and subshrub layers in greater abundance than on Mesic Udic Forest sites. Salal is a common component in the understory shrub layer. Site indices for Mesic Udic Dry Forests are generally lower than for Mesic Udic Forests.

Associated sites

AX001X01X200	**Temperate Wet Meadow** Temperate Wet Meadow sites may be found adjacent to or surrounded by Mesic Udic Dry Forest sites. Temperate Wet Meadows occur on depressions and seeps. Temperate Wet Meadow sites lack tree cover.
AX001X01X402	**Mesic Udic Moist Forest** Mesic Udic Moist Forest sites may occur downslope of Mesic Udic Dry Forest sites and generally have more stable slope gradients. Mesic Udic Moist Forest sites have higher productivity. Mesic Udic Moist Forest sites typically support salmonberry (Rubus spectabilis).

AX001X01X004	**Mesic Aquic Forest** Mesic Aquic Forest sites may occur downslope or in mosaic with Mesic Udic Dry Forest sites. Mesic Aquic Forest sites occur on depressions and seeps and are subject to ponding.

Similar sites

AX001X01X401	**Mesic Udic Forest** Mesic Udic Forest sites are located on the windward side of the Olympic mountains and receive higher precipitation. Production on Mesic Udic Forest sites is significantly higher.
AX001X01X408	**Frigid Udic Dry Forest** Frigid Udic Dry Forest sites are located at higher elevations and support Pacific silver-fir (Abies amabilis).

Table 1. Dominant plant species

Tree	(1) *Tsuga heterophylla* (2) *Pseudotsuga menziesii*
Shrub	(1) *Holodiscus discolor* (2) *Rosa gymnocarpa*
Herbaceous	(1) *Polystichum munitum* (2) *Achlys triphylla*

Legacy ID

F001XA403WA

Physiographic features

This site primarily occurs on glacial valley walls, moraines, and colluvial aprons on mountains. These upland forest sites are strongly influenced by slope gradient. Mesic Udic Dry Forest sites typically are found on less stable slopes and generate run-off that is collected by more stable Mesic Udic Moist Forest, Mesic Aquic Forest, or Temperate Wet Meadow sites. Mesic Udic Dry Forest sites lose a significant amount of moisture via run-off.

Table 2. Representative physiographic features

Landforms	(1) Mountains (2) Glacial-valley wall (3) Colluvial apron (4) Moraine
Flooding frequency	None
Ponding frequency	None

Elevation	300 – 1,000 m
Slope	40 – 100 %
Water table depth	150 cm
Aspect	W, NW, N, NE, E, SE, S, SW

Climatic features

This site occurs in a mesic temperature and udic moisture regime. Precipitation arrives mostly via low-intensity, Pacific frontal storms. Precipitation is unevenly distributed, with the lowest amounts on the leeward side of the Coast Range mountains. Precipitation falls largely as snow in higher elevations. Precipitation is evenly distributed throughout the fall, winter, and spring, while summers are dry. Air temperatures vary significantly along the elevation gradient.

Table 3 Representative climatic features

Frost-free period (characteristic range)	180-240 days
Freeze-free period (characteristic range)	
Precipitation total (characteristic range)	990-1,400 mm

Influencing water features

There are no dominant water features influencing plant community dynamics on site.

Soil features

The soils that support this ecological site occur in the mesic soil temperature regime and the udic soil moisture regime. Sentinelpeak soils are well drained, very deep, formed in colluvium, and occur on colluvial aprons and glacial valley walls. Saturated hydraulic conductivity is high or very high throughout. These soils have greater than 35 percent rock fragments in the control section and have silt loam, loam, and sandy loam textures. The Sentinelpeak soils occur primarily in the rainshadow of the Olympic Peninsula, so they are drier than their counterparts on the west side. Less available water in these soils is the primary limiting factor to plant growth. Thin organic layers protect the soil from wind and water erosion. Although representative of this site, these soils may exist across multiple ecological sites because of naturally variable slope, texture, rock fragments, and pH. An on-site soil pit and the most current ecological site key are necessary to classify a site.

Table 4. Representative soil features

Parent material	(1) Colluvium
Surface texture	(1) Gravelly loam (2) Very gravelly silt loam (3) Extremely gravelly sandy loam

Drainage class	Well drained
Soil depth	150 cm
Surface fragment cover <=3"	0 – 10 %
Surface fragment cover >3"	Not specified
Available water capacity (0-101.6cm)	9.4 – 13.46 cm
Soil reaction (1:1 water) (0-25.4cm)	4.5 – 5.5
Subsurface fragment volume <=3" (0-50.8cm)	10 – 60 %
Subsurface fragment volume >3" (0-50.8cm)	0 – 30 %

Ecological dynamics

Frequent, small-scale disturbance from windthrow events create a mosaic fabric of early-seral patches within late-seral communities. Canopy gaps created by windthrow favor establishment of western white pine and bigleaf maple (Acer macrophyllum). Western white pine is susceptible to white pine blister rust (Cronartium ribicola) infection. This introduced fungus is responsible for the widespread mortality of western white pine, especially West of the Cascades (Schwandt et al., 2013). Most western white pines on this site become infected and die before they mature. As the canopy closes, bigleaf maple often fails to grow and regenerate in the absence of adequate sunlight. Dominant conifers on this site are susceptible to a variety of root and butt rot fungi. Wood decay fungi exacerbate mature trees' vulnerability to windthrow events.

Infrequent, large-scale disturbances may occur in the form of stand-replacing wildfires, cataclysmic wind events, or large mass movement events. High-force windstorms are a major source of large-scale disturbance in these forests. These blowdown events may be stand replacing and conditions tend to favor shade-intolerant species in their aftermath (Van Pelt, 2007). The fire regime of the Olympic Peninsula is characterized by high-intensity, stand-replacing fires with a long return interval of greater than 100 years (Agee, 1987). Though infrequent, wildfires have a profound influence on the composition of these forests. Douglas-fir is a shade-intolerant species and generally requires a stand-replacing wildfire to clear canopy for successful recruitment and regeneration. In the absence of large-scale disturbance, more shade-tolerant western hemlock regenerates successfully and gradually succeeds Douglas-fir. The longevity of Douglas-fir preserves evidence of historical high-intensity fire events. Large mass-movement events also provide conditions for the initiation of primary succession. Landslides are a significant source of disturbance, owing to the steep terrain and sedimentary geology of the park. (Gavin, 2014). As with stand-replacing wildfires, bare patches created by landslides favor the establishment of non-shade tolerant Douglas-fir (Geertsema & Pojar, 2007).

Douglas-fir and western white pine (Pinus monticola) recruits regenerate in the aftermath of stand-replacing disturbance, accompanied by California blackberry (Rubus ursinus) and fireweed (Chamerion angustifolium). As Douglas-fir grows and forms a discrete canopy, the understory community diversifies. Shrub and forb layers develop, dominated by Cascade barberry and oceanspray, and western swordfern and shyleaf (Aeschynomene americana), locally known as deer vetch, respectively. As the canopy begins to mature, dwarf rose is established in the shrub layer and sweet after death in the forb layer. Western hemlock begins to establish and grow under the canopy. With time, Western hemlock will grow into the canopy layer, eventually beginning to replace Douglas-fir on this site.

Changes in disturbance frequency or intensity through human alteration of the natural fire regime and a changing climate may promote shifts in community structure and function. For example, fire suppression efforts will likely shift communities further towards shade-tolerant western hemlock-dominated seral stage. (Reed, 2010) Alternatively, increased fire frequency in some areas due to human activity will encourage Douglas-fir recruitment and establishment. (Gavin, 2015)

State and transition model

Additional community tables

Table 5. Community 1.1 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production ()	Foliar Cover (%)

Table 6. Community 1.2 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production ()	Foliar Cover (%)

Table 7. Community 1.3 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production ()	Foliar Cover (%)

Table 8. Community 1.4 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production ()	Foliar Cover (%)

Table 9. Community 1.5 plant community composition

Group	Common Name	Symbol	Scientific Name	Annual Production ()	Foliar Cover (%)

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Approval

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Rangeland health reference sheet

Interpreting Indicators of Rangeland Health is a qualitative assessment protocol used to determine ecosystem condition based on benchmark characteristics described in the Reference Sheet. A suite of 17 (or more) indicators are typically considered in an assessment. The ecological site(s) representative of an assessment location must be known prior to applying the protocol and must be verified based on soils and climate. Current plant community cannot be used to identify the ecological site.

Author(s)/participant(s)	
Contact for lead author	

Date	09/23/2026
Approved by	
Approval date	
Composition (Indicators 10 and 12) based on	Annual Production

Indicators

1. **Number and extent of rills:**

2. **Presence of water flow patterns:**

3. **Number and height of erosional pedestals or terracettes:**

4. **Bare ground from Ecological Site Description or other studies (rock, litter, lichen, moss, plant canopy are not bare ground):**

5. **Number of gullies and erosion associated with gullies:**

6. **Extent of wind scoured, blowouts and/or depositional areas:**

7. **Amount of litter movement (describe size and distance expected to travel):**

8. **Soil surface (top few mm) resistance to erosion (stability values are averages - most sites will show a range of values):**

9. **Soil surface structure and SOM content (include type of structure and A-horizon color and thickness):**

10. **Effect of community phase composition (relative proportion of different functional groups) and spatial distribution on infiltration and runoff:**

11. **Presence and thickness of compaction layer (usually none; describe soil profile features which may be mistaken for compaction on this site):**

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12. **Functional/Structural Groups (list in order of descending dominance by above-ground annual-production or live foliar cover using symbols: >>, >, = to indicate much greater than, greater than, and equal to):**

Dominant:

Sub-dominant:

Other:

Additional:

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13. **Amount of plant mortality and decadence (include which functional groups are expected to show mortality or decadence):**

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14. **Average percent litter cover (%) and depth (in):**

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15. **Expected annual annual-production (this is TOTAL above-ground annual-production, not just forage annual-production):**

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16. **Potential invasive (including noxious) species (native and non-native). List species which BOTH characterize degraded states and have the potential to become a dominant or co-dominant species on the ecological site if their future establishment and growth is not actively controlled by management interventions. Species that become dominant for only one to several years (e.g., short-term response to drought or wildfire) are not invasive plants. Note that unlike other indicators, we are describing what is NOT expected in the reference state for the ecological site:**

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17. **Perennial plant reproductive capability:**
